7. The groin flap: a new technique to repair traumatic tissue defects

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Tissue loss from trauma, particularly in the hand and forearm, occasionally requires immediate skin-flap coverage to ensure optimal healing. A consistently safe technique of skin-flap coverage is use of a groin flap. Anatomic studies of this flap have revealed the reliability of blood supply by the superficial circumflex iliac vessels to an area of skin and subcutaneous tissue running parallel to the inguinal ligament lateral to the femoral artery, and the axial relation of the vessels to the flap allows the surgeon to take a longer flap than usual without fear of vascular embarrassment.

Three case reports illustrate the value of the groin flap in primary soft-tissue closure and in the treatment of acute traumatic injuries.

La perte de tissu résultant d'un traumatisme, particulièrement lorsqu'il affecte la main ou l'avant bras, exige à l'occasion que l'on procède à une greffe de peau afin d'assurer une guérison optimale.

Une technique uniformément sûre de greffe cutanée consiste à utiliser un greffon de la région inguinale. Des études anatomiques de ce greffon ont mis en évidence le bon apport sanguin des vaisseaux iliaques circonflexes à une surface de peau et de tissu sous-cutané qui est parallèle au ligament inguinal latéral à l'artère fémorale, et l'axe des vaisseaux par rapport au greffon permet au chirurgien de prélever un greffon plus long que d'habitude, sans crainte de complication vasculaire.

Trois cas sont présentés afin d'illustrer l'intérêt du greffon inguinal pour la fermeture primaire des lésions des tissus mous et dans le traitement des traumatismes aigus.

Loss of skin and subcutaneous tissue frequently results from serious trauma. The simplest treatment of these injuries is split-thickness skin grafting. However, in many areas, such as the hand, forearm and face, this form of treatment on occasion is inadequate, and application of full-thickness skin and subcutaneous tissue in the form of a flap is preferred in order to obtain optimal function and appearance.

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Classically, flaps have been made by incising three sides of an area of skin and leaving the fourth side (the base) to provide an adequate blood supply to the circumscribed area, which is then raised and set into the skin defect. Blood vessels entering such a flap have been those that have happened to be present at the base of the flap. In this type of random flap the usual ratio of the length to the base of the flap is about 1.5:1.

A major advance in the transfer of tissue was the development of the axial flap, which is based on the known pattern of specific blood vessels.[1,2] The flap is cut so that the vessels enter the base and course through the long axis of the flap — that is, the blood supply to the flap is planned and not random. Surgeons have used the acromioclavicular and forehead flaps for over 50 years because of the reliability of known vessels in these flaps,[3] and the benefits of axial flaps are now increasingly appreciated. In 1965 Bakamjian[4] described the deltopectoral flap based on the upper three or four perforating intercostal vessels — a most useful contribution, particularly in head and neck cancer surgery when reconstruction is required. Then, in 1972 McGregor and Jackson[5] described a new axial flap, which they called the groin flap. Their procedure has been an important advance in the reconstruction of traumatic tissue defects.

In this paper the groin flap is discussed from anatomic, technical and clinical viewpoints, and three illustrative case reports are described.

Anatomic basis of the groin flap

The design of the flap is based on anatomic studies performed by Smith and colleagues,[6] who found the superficial circumflex artery to be consistently present in all dissections undertaken. This vessel (usual diameter, 2 mm) arises from the femoral artery 0.5 cm to 5 cm below the inguinal ligament and runs parallel to the ligament as it travels laterally and somewhat superiorly (Fig. 1). Beyond the anterosuperior iliac spine the vessel usually divides into three branches. The accompanying venous drainage of the flap is substantial. The veins are numerous, of greater calibre than the artery and drain into the saphenous vein adjacent to the fossa ovalis; venae comitantes accompany the artery.

The depth of the vessels from the skin varies with the adiposity of the subject, but the vessels become more superficial as they progress laterally. The artery is usually found to pierce the fascia lata on the lateral side of the saphenous opening at the medial border of the sartorius muscle.

Taylor and Daniel,[7] who performed 100 dissections, demonstrated that the superficial circumflex iliac artery often arises in combination with the superficial inferior epigastric artery rather than directly from the femoral artery. Since the variation occurs at the origin of the artery, however, it does not affect the anatomic basis of this flap.

These anatomic studies reveal that a long section of skin and subcutaneous tissue is supplied by an artery whose presence and course are highly consistent, that the venous drainage of this area is excellent and that the veins drain into the saphenous vein at a point close to the origin of the artery. This section of skin and subcutaneous tissue is ideal for use as an axial flap.

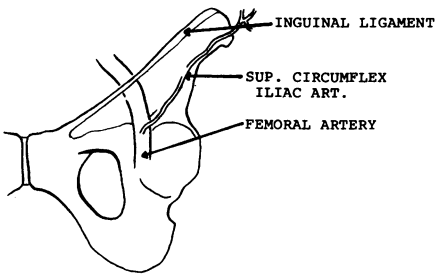

FIG. 1—Relation of superficial circumflex artery to inguinal ligament and femoral artery.

Technique of design and execution of the flap

Since the flap is based on the course of the superficial circumflex iliac vessels, it is extended from 25 to 30 cm from the origin of these vessels in the direction of the vessel laterally and obliquely upwards (Fig. 2). The width of the flap varies from 7.5 to 10 cm depending on the width of the defect to be covered. The inguinal ligament is slightly above the median axis of the flap. The flap is raised from the lateral to the medial side, and on the medial side of the anterior superior iliac spine

the fascia lata is included in the flap. This avoids injury to the artery, which is just superficial to the fascia in this area. The medial end of the flap lies at the medial border of the sartorius muscle. Further dissection endangers the artery, which pierces the fascia lata just medial to this landmark.

The exact potential length of this type of flap is still uncertain. In one case McGregor and Jackson[5] extended the flap to the midline of the back and in another to the lateral border of the sacrospinalis muscle. Although there was patchy necrosis of the distal ends of both flaps, spontaneous healing occurred. This suggested that the maximum safe length of the flap is to a point two thirds of the distance to the sacrospinalis muscle from the base. In the majority of cases the resulting defect in the groin requires a split-thickness skin graft.

The flap is quite mobile. After it has been set into the defect the unused pedicle can easily be tubed to avoid an open wound. The hand and forearm are common areas for the use of this flap. The grafted limb is totally immobilized to the abdomen, usually with adhesive tape, so that the flap rests comfortably without undue stretch. Usually about 10 days' bed rest are required after the first stage. At about 3 weeks, the flap can be detached from the groin, as the second stage, and soon afterwards the patient can be discharged from hospital.

Some care must be taken at the second stage when a sizeable portion of the flap remains to be set into the recipient site, or when the flap is being transferred on a wrist carrier. To ensure a sufficient blood supply of its new attachment a delay procedure at 3 weeks is recommended. The superficial circumflex iliac artery is ligated leaving the major portion of the base intact. This promotes added inflow to the new attachment from the recipient end and safeguards viability of the flaps when it is detached 1 week later. When 80% or more of the flap is set in at the initial operation, however, no delay procedure is needed.

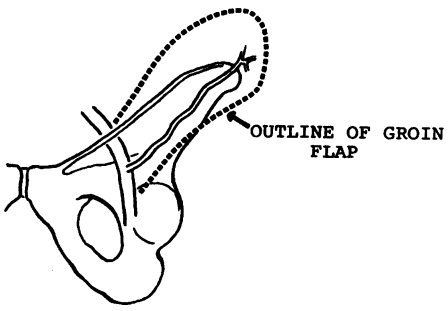

FIG. 2—Outline of groin flap in relation to inguinal ligament and superficial circumflex iliac artery.

Uses of the groin flap

The main use of the flap has been coverage for the hand and wrist area — that is, primary treatment of acute traumatic injury. The flap is available to resurface either the dorsal or palmar aspects of the hand, or both. The freedom of movement of the long pedicle permits a full range of movement of the wrist and fingers within a few days of operation, and the position of the elbow and shoulder is comfortable. The groin flap is also excellent for resurfacing large areas of the forearm up to the elbow. It may also be used as a local transposed flap to resurface defects in the opposite groin or perineal areas. Finally, it is an excellent substitute for the classic abdominal tubed pedicle flap. The groin flap can be raised, tubed and attached to the wrist carrier in a single stage, thus reducing the length of the procedure by 3 weeks. The increased flexibility and softness of the flap allow attachment to either border of the wrist at an angle suitable for the needs of the next stage of the transfer.

Advantages of the groin flap

The groin flap, being an axial flap, has a length-to-base ratio that is about three times greater than the classic abdominal flap. This makes it more mobile, which in turn permits freedom of movement of the fingers. In addition, the unused portion of the flap can be tubed to create a closed wound; this reduces the chance of infection. Also, because of the excellent axial blood supply troublesome vascular complications such as rim necrosis of the distal flap are rare.

The groin flap has several advantages over the other axial flaps such as the deltopectoral flap. The donor site is in an inconspicuous location. This is particularly important in women in whom a deltopectoral flap would result in a large scar in the upper anterior chest wall. Furthermore, the distal portion of the groin flap, which is the part set into the recipient site, is usually hairless, even in hirsute individuals. The subcutaneous tissue is often thinner in the useable part of the groin flap and this diminishes the unsightly bulk that is often associated with other abdominal flaps. Where a bone graft is required, it can be taken simultaneously from the iliac crest after the flap has been raised. Finally, because of the excellent venous drainage at its base there is an almost total lack of edema in this type of flap.

Drawbacks to its use are the tendency (as with all abdominal flaps) to become bulky if the patient puts on weight, and the need for bed immobilization postoperatively. These seem a small price to pay. The latter is an insignificant objection since the associated trauma is usually sufficient to warrant a hospital stay of about 1 month. Any undesirable bulkiness of the flap resulting from increasing weight of the patient can be corrected.

Case reports

Case 1

A 19-year-old man amputated his left hand in an industrial press through the ulnar three fingers at the metacarpophalangeal joints and the index finger through the proximal phalanx. Avulsion and severe damage to the skin on the dorsal and volar aspects of the hand left a skin deficit of approximately 2.5 cm, proximal to the sites of the amputation (Figs. 3A and 3B). Following debridement of the wound (Fig. 3C) coverage was obtained by the use of a left groin flap (Fig. 3D). He was discharged with the wound healed 32 days after his accident.

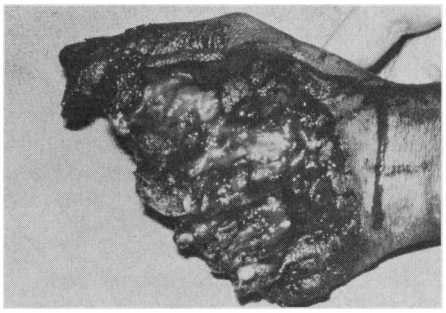

FIG. 3A—Injury to left hand causing loss of fingers and skin from dorsum (case 1).

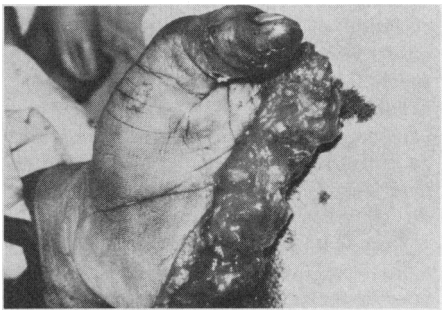

FIG. 3B—Loss of skin from palmar aspect proximal to amputation site (case 1).

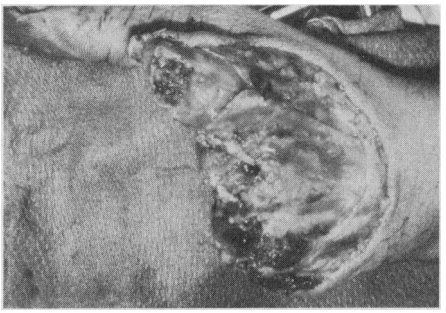

FIG. 3C—Dorsal view of left hand after debridement and preparation of groin flap (case 1).

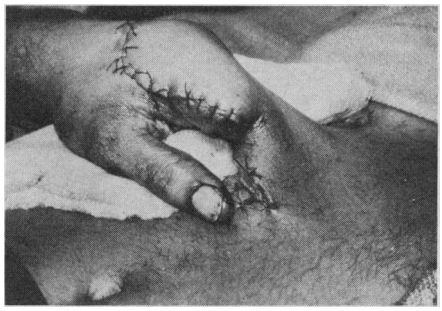

FIG. 3D—Left hand inserted into groin flap (case 1).

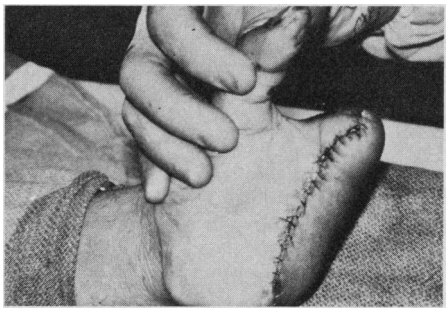

FIG. 3E—Palmar view of groin flap after inset (case 1).

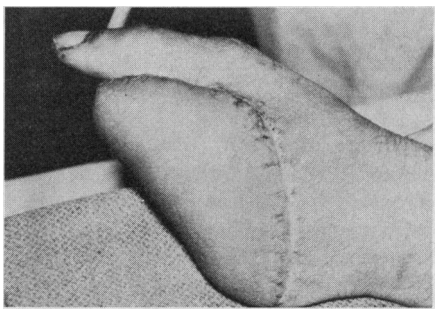

FIG. 3F—Dorsal view of left hand showing healed groin flap (case 1).

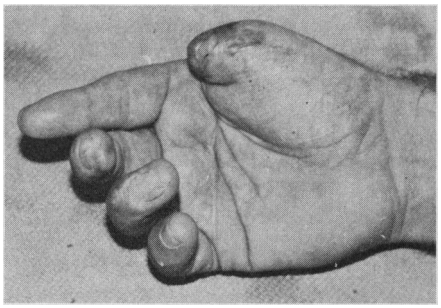

FIG. 4A—Injury to right hand resulting in ineffective amputation of thumb just distal to metacarpophalangeal joint (case 2).

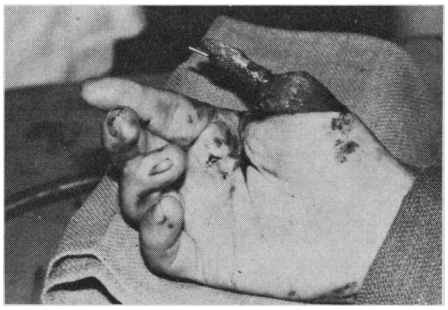

FIG. 4B—Iliac bone graft held in place with Kirschner wire (case 2).

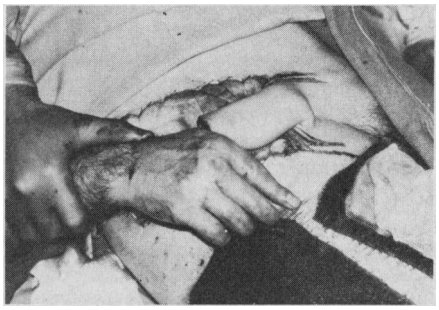

FIG. 4C—Right thumb attached to right groin flap (case 2).

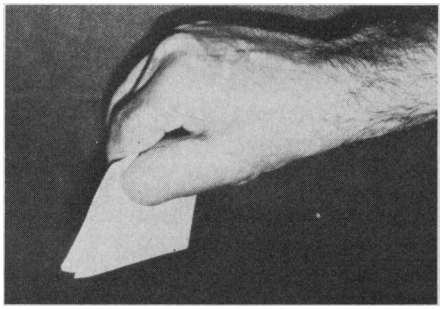

FIG. 4D—Reconstruction of right thumb with right groin flap giving good power and sensation (case 2).

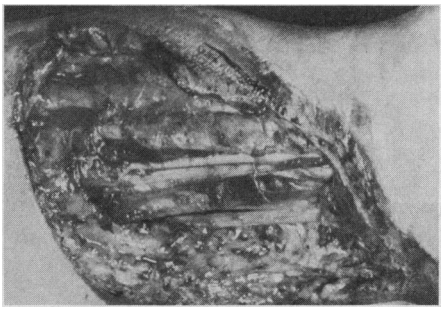

FIG. 5A—Injury to right wrist causing defect of volar aspect of right forearm with loss of superficial flexor tendons and median nerve (case 3).

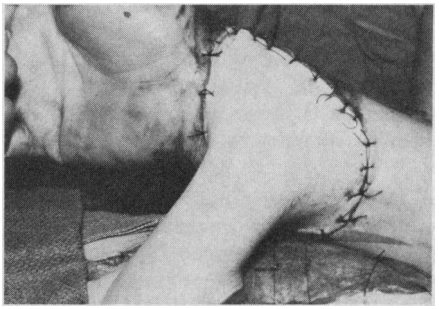

FIG. 5B—Defect on right wrist adequately covered by right groin flap (case 3).

Comment: This case illustrates two important advantages of the groin flap: first, the hairless, relatively thin flap provided a suitable coverage at the remaining distal end of the hand; and second, the patient had a dark complexion but the resulting scar on his abdomen was in a relatively hidden area.

Case 2

A 40-year-old man caught both hands in a hot moulding press, sustaining multiple lacerations, fractures and burns to both hands. The most severe injury involved the right thumb, which ultimately became necrotic just distal to the metacarpophalangeal joint. Because of restriction of motion of the other fingers the shortened scarred stump of the thumb was ineffective (Fig. 4A). Some months after the injury the thumb was reconstructed by means of a right groin flap in addition to a right iliac bone graft (Figs. 4B and 4C). The flap healed and the bone graft fused satisfactorily to the stump of his proximal phalanx. He has since had a neurovascular island flap raised from his right finger to improve sensation in the reconstructed thumb (Figs. 4D, 4E and 4F).

Comment: This man was hirsute and obese. The iliac crest area provided both the best available hairless flap tissue for reconstruction of his thumb and simultaneous excellent exposure of the iliac bone graft.

Case 3

A 45-year-old woman, who was dragged under a car for an indeterminate distance, sustained loss of soft tissue on the volar aspect of her right wrist, superficial flexor tendons and a portion of the median nerve (Fig. 5A). Initial treatment was closure of the skin defect using a groin flap (Fig. 5B). This healed satisfactorily. Subsequently cable nerve grafting was performed in reconstruction of the missing portion of the median nerve at the wrist.

Comment: Flap tissue was necessary in this case because of the missing median nerve and the plan to reconstruct it by cable graft at a later operation. The groin flap provided good coverage with a sufficiently long pedicle so that the mobility of the patient's hand could be maintained postoperatively. The scar, too, was inconspicuous.

Conclusion

As these three cases demonstrate, the groin flap provides a safe practical way of providing soft-tissue coverage, both as a primary form of treatment in trauma and later in secondary reconstructive procedures.

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